



# EFFECT OF MINDFULNESS-BASED INTERVENTION ON META-COGNITIVE SKILLS OF ELEMENTARY SCHOOL STUDENTS

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## ABSTRACT

Meta-cognitive skills are important organizers of all the tasks that we perform. Broadly, it includes declarative knowledge, conditional knowledge, planning, self-regulation, evaluation, and procedural knowledge of students. In the present study, Mindfulness has been chosen as a focal point of research because of its relevance as an emerging technique of intervention to improve the meta-cognitive skills among students. The sample for the study consisted of students in the age group of 10-12 years. The eight weeks long intervention was provided to students in the experimental group (EG). The study yielded significant results, which has valuable implications for students and trainers in the academic settings.

**KEYWORDS:** Mindfulness; mindfulness-based intervention; meta-cognition; meta-cognitive skills.

## INTRODUCTION:

*"I cannot teach anybody anything, I can only make them think."*

- Socrates

The term 'meta-cognition' means thinking beyond thinking, or thinking about thinking. This term was first coined by Flavell (1979). According to him, meta-cognition is a regulatory system that includes (a) knowledge, (b) experiences, (c) goals, and (d) strategies. Meta-cognitive skills are theorized as an interconnected set of competencies for learning and thinking, and include many of the skills required for critical thinking, active learning, reflective judgment, problem solving and decision making.

*"Nothing is more difficult, and therefore more precious, than to be able to decide."*

-Napoleon (as cited in Roberto, 2002)

Individuals with well-developed meta-cognitive skills give deep thought to a problem, approach a learning task, select appropriate strategies, and make decisions about a course of action to resolve the problem or effectively perform the task. They often think about their own thinking processes, taking time to think about and learn from mistakes or inaccuracies (Kujawa & Huske, 1995). Metacognitive skills are important organizers of all of the tasks that we perform. Students with metacognitive needs are neither effective at planning, nor can manage their own work from beginning to end. They might also have difficulty in seeking assistance when they are unable to start or complete their work or meet deadlines (Aleven, McLaren, Roll, & Koedinger, 2006).

Metacognition is concerned with what one is thinking about whereas mindfulness is concerned with how one thinks as one goes about what one is doing. Mindful individuals maintain enough distance from their own thoughts to view them impartially, and this aspect of mindfulness makes it a meta-cognitive skill, involving cognition about cognition (Kabat-Zinn, 1990). Mindfulness practice requires the activation of meta-cognitive knowledge, monitoring, and control (Wells, 2005). In the present study, Mindfulness is the focal point of research because of its relevance as an emerging technique of intervention across age groups and across wide range of settings.

It's been reported that a deficit of meta-cognitive skills can lead to poor academic performance that eventually results in poor self-esteem, academic stress and anxiety. It is therefore important that students are taught effective strategies that may guard students against undue stress, particularly so because the early childhood stress is a precursor for adulthood stress, and the stressful life events are related to poor performance (Napoli, Krech and Holley, 2005). Mindfulness based training has yielded encouraging results in significantly enhancing the self-esteem (Kashyap & Kaur, 2017); improving the planning and self-regulation skills (Sarita & Kaur, 2017) and lowering the reading anxiety among the learners (Kashyap & Kaur, 2017). In light of the foregoing arguments, a strong urge for carrying out the present study was felt.

## OPERATIONAL DEFINITIONS OF KEY TERMS:

**META-COGNITIVE SKILLS:** These include knowledge and regulation about self. It consists of six dimensions viz. declarative knowledge, conditional knowledge, procedural knowledge, planning, monitoring/self-regulation and evaluation. In the present study, metacognitive skills were assessed using Meta-

Cognition Questionnaire for School Children (MQSC) developed by Sarita & Kaur (2017).

## MINDFULNESS BASED INTERVENTION:

Mindfulness, as a concept, consists of self awareness, observation, acceptance and non-judgment. The self-prepared modules for mindfulness-based intervention, therefore included following components:

- self-awareness, through activities like mindful posing, heartbeat exercise
- observation, through activities like mindful coloring, mindful eating
- alertness, through activities like mindful walking, mindful dragon breathing
- non-judgmental, through activities like mindful listening, body scan
- paying attention, through activities like think a word
- compassion, through activities like mindful stories
- describing, through activities like observe and describe

The activities listed against each are indicative – many other similar activities were part of the intervention program.

## OBJECTIVES AND HYPOTHESES OF THE STUDY:

**Objective 1:** To study the difference in pre-test and post-test mean scores on meta-cognitive skills of students in Control Group.

**H<sub>0</sub>1:** There is no significant difference in the pre-test and post-test meta-cognitive mean scores of students in Control Group.

**H<sub>A</sub>1:** There is significant difference in the pre-test and post-test meta-cognitive mean scores of students in Control Group.

**Objective 2:** To study the difference in pre-test and post-test mean scores on meta-cognitive skills of students in Experiment Group.

**H<sub>0</sub>2:** There is no significant difference in the pre-test and post-test meta-cognitive mean scores of students in Experiment Group.

**H<sub>A</sub>2:** There is significant difference in the pre-test and post-test meta-cognitive mean scores of students in Experiment Group.

**Objective 3:** To study the effect of Mindfulness-based intervention on meta-cognitive skills of students (by comparing mean gain score differences of CG and EG).

**H<sub>0</sub>3:** There is no significant effect of Mindfulness based intervention on meta-cognitive Skills of students.

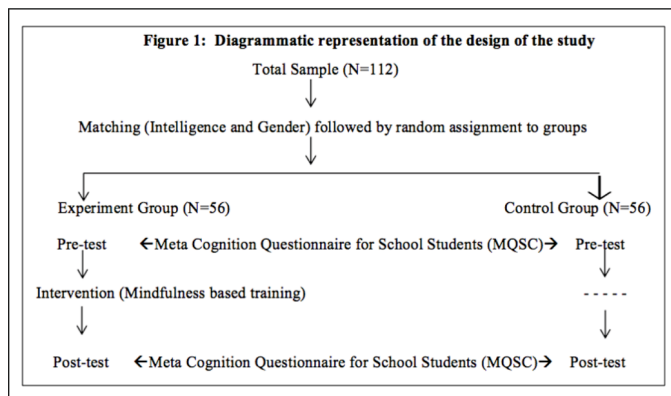
**H<sub>A</sub>3:** There is significant effect of Mindfulness based intervention on meta-

cognitive Skills of students.

## RESEARCH METHODOLOGY:

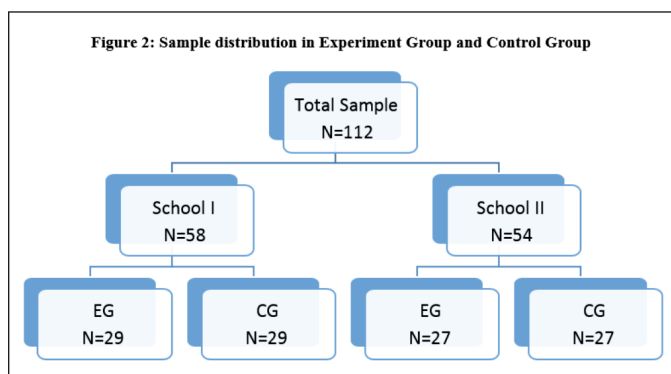
### DESIGN OF THE STUDY:

The study is experimental in nature having pre-test post-test control group design (Figure. 1).



### SAMPLING AND SAMPLE:

The population for the study comprised of 6<sup>th</sup> Grade students studying in the government schools affiliated to C.B.S.E. and located in Union Territory, Chandigarh (India). For the purpose of the study, two schools were selected randomly from the list of schools that was shortlisted and approved by the District Education Office (D.E.O.) to carry out this research work. From the selected schools, a sample of 123 students was matched on intelligence and gender. The final sample consisted of 112 students who were then randomly assigned to the experimental group (EG, N=56) and control group (CG, N=56). Further it was ensured that students in EG and CG groups were equally distributed in two schools. The school wise and group wise sample distribution is shown in Figure 2.



### TOOLS USED:

1. Meta-Cognition Questionnaires for School Children (MQSC) developed by Sarita and Kaur (2017) measured the meta cognition level of students on six dimensions viz. declarative knowledge, conditional knowledge, procedural knowledge, planning, monitoring/self-regulation and evaluation.
2. Self-prepared modules for eight weeks' Mindfulness based intervention

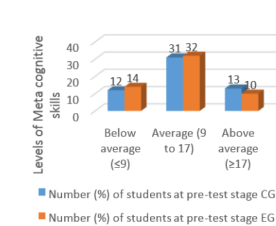
### META-COGNITIVE SKILLS AMONG STUDENTS IN CONTROL GROUP AND EXPERIMENT GROUP:

After analyzing data of meta-cognitive scores descriptively for students in the control group and experiment group, it was found that at the pretest stage, both groups are nearly equivalent. The analysis of post-test meta-cognitive scores indicate difference in the control group and experiment group. An attempt was made to group the sample into different levels based on their performance on Meta-Cognition Questionnaire for School Children (MQSC).

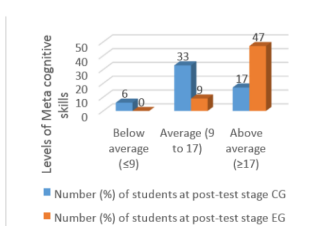
**Table 1: Levels of Meta-Cognitive Skills among students at Pre-test Stage and Post-test Stage**

Levels of Meta cognitive skills	Students at pre-test stage (Number & %)		Students at post-test stage (Number & %)	
	CG	EG	CG	EG
Below average ( $\leq 9$ )	12 (21.43%)	14 (25%)	6 (10.71%)	0 (0)
Average (9 to 17)	31 (55.36%)	32 (57.14%)	33 (58.93%)	9 (16.07%)
Above average ( $\geq 17$ )	13 (23.21%)	10 (17.86%)	17 (30.36%)	47 (83.93%)
Total	56	56	56	56

**Figure 3: Levels of Meta-Cognitive Skills among students at Pre-test Stage**



**Figure 4: Levels of Meta-Cognitive Skills among students at Post-test Stage**



### DESCRIPTIVE ANALYSIS FOR ASSESSMENT OF META-COGNITIVE SKILLS:

**Table 2: Descriptive statistics for meta-cognitive skills of students in CG (N=56) and EG (N=56) at Pre-test Stage**

Meta-cognitive skills	Pre-Test Stage (Control Group)	Pre-Test Stage (Experimental Group)
Mean	13.2500	12.5714
Median	13.5000	13.0000
Mode	9.00	9.00
Std. Deviation	4.08656	3.61239
Variance	16.700	13.049
Skewness	-.371	-.481
Std. Error of Skewness	.319	.319
Kurtosis	-.216	.256
Std. Error of Kurtosis	.628	.628
Minimum score	2.00	2.00
Maximum score	20.00	19.00
Range	18.00	17.00
Skewness / Std. Error of Skewness	-1.16208	-1.50819
Kurtosis / Std. Error of Kurtosis	-0.34329	0.40678

Table 2 shows that the mean scores for meta-cognitive skills (Total) are 13.2500 and 12.5714 for CG and EG at the pre-test stage with standard deviation of 4.087 and 3.612 respectively. The value of skewness for CG was -.371 and that for EG was -.481. The value of kurtosis for CG was -.216 and that for EG was -.256. A z-test was applied for normality test using skewness and kurtosis. The z-scores for skewness and kurtosis for CG (-1.16208 and -0.34329) and EG (-1.50819 and 0.40678) respectively lie within the acceptable limits i.e.  $\pm 1.96$ , thus, the distribution of measure can be considered as normal for both CG and EG.

### HOMOGENEITY OF VARIANCE ON META-COGNITIVE SKILLS SCORES:

The assumption of equal variance in the pre-test scores for meta-cognitive skills of students in CG and EG has been tested using Levene's test (Table 3).

**Table 3: Homogeneity of Variance in groups on Meta-cognitive scores (Pre-test Stage)**

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.430	1	110	.234

As seen from Table 3, the Levene statistic for pre-test meta-cognitive skills scores of students is 1.430, with between the groups degrees of freedom (df1) as 1 and for within groups (df2) as 110. The p-value came out to be 0.234 which is not statistically significant. This implies that there exist equal variances on meta-cognitive skills scores in CG and EG at the pre-test stage.

**Objective 1:** To study the difference in pre-test and post-test mean scores on meta-cognitive skills of students in Control Group.

**H<sub>0</sub>1:** There is no significant difference in the pre-test and post-test meta-cognitive mean scores of students in Control Group.

**H<sub>A</sub>1:** There is significant difference in the pre-test and post-test meta-cognitive mean scores of students in Control Group.

In order to test the null hypothesis, paired samples t-test was applied on the pre-test and post-test meta-cognitive mean scores of students in the control group. The results are presented in Table 4.

**Table 4: Paired Samples t-test for Pre-test and Post-test Mean Scores on meta-cognitive skills of Students in Control Group (N=56)**

Group	Mean	SD	SE <sub>M</sub>	df	Mean Difference	SE <sub>D</sub>	t-value (p-value)
Pre-test	13.25	4.087	.546	55	.9464	.1659	t= 5.702 p=.0001**
Post-test	14.196	3.979	.532				

As presented in Table 4, the difference in pre-test and post-test mean scores on meta-cognitive skills of students in Control Group was found to be 0.9464. As compared to the critical (table) value, the obtained t-value i.e.,  $t = 5.702$  ( $p = .0001$ ), was found to be statistically significant. Hence the null hypothesis stating "There exists no significant difference in the pre-test and post-test mean scores on metacognitive skills of students in Control Group." is rejected. Alternatively, in light of available evidence, the hypothesis stating "There exists significant difference in the pre-test and post-test meta-cognitive mean scores of students in Control Group" is proven correct. The result shows that the students in the CG has made significant improvement in meta-cognitive skills even when no intervention was provided to this group.

**Objective 2:** To study the difference in pre-test and post-test mean scores on meta-cognitive skills of students in Experiment Group.

**H<sub>02</sub>:** There is no significant difference in the pre-test and post-test meta-cognitive mean scores of students in Experiment Group.

**H<sub>A2</sub>:** There is significant difference in the pre-test and post-test meta-cognitive mean scores of students in Experiment Group.

In order to test the null hypothesis, paired samples t-test was applied on the pre-test and post-test meta-cognitive mean scores of students in the experiment group (EG). The results are presented in Table 5.

**Table 5: Paired Samples t-test for Pre-test and Post-test Mean Scores on Meta-cognitive skills of Students in Experiment Group**

Group	Mean	SD	SE <sub>M</sub>	df	Mean Difference	SE <sub>D</sub>	t-value (p-value)
Pre-test	12.57	3.61	.483	55	9.768	.748	t= 13.056 p=.0001**
Post-test	22.34	4.65	.621				

As presented in Table 5, the difference in the pre-test and post-test mean scores on meta-cognitive skills of students in the Experiment Group was found to be 9.768. As compared to the critical (table) value, the obtained t-value i.e.,  $t = 13.056$ ,  $p = .0001$  was found to be statistically significant. Hence, the null hypothesis stating "There exists no significant difference in the pre-test and posttest mean scores on meta-cognitive skills of students in Experiment Group" stands rejected. The present evidence proves the alternative hypothesis correct stating "There exists significant differences in the pre-test and post-test meta-cognitive mean scores of students in Experiment Group."

**Objective 3:** To study the effect of Mindfulness intervention on meta-cognitive Skills of students (by comparing mean gain score differences of CG and EG).

**H<sub>03</sub>:** There is no significant effect of Mindfulness-based intervention on meta-cognitive skills of students.

**H<sub>A3</sub>:** There is significant effect of Mindfulness-based intervention on meta-cognitive skills of students.

**Table 6: Independent Samples t-test for Mean Gain Scores on meta-cognitive skills of students in Control and Experiment Group**

Group	Mean Gain scores	SD	SE <sub>M</sub>	Df	Difference in mean (Post-Pre)	SE <sub>D</sub>	t-value (p-value)
CG	.946	1.242	.166	110	8.822	.766	t= 10.34 (p= .0001**)
EG	9.768	5.598	.748				

As shown in Table 6, the mean gain scores on meta-cognitive skills of students in the Control Group and Experiment Group were found to be .946 and 9.768 respectively. As compared to the critical (table) value, the obtained t-value, i.e.,  $t = 10.34$ ,  $p = .0001$ , was found to be significant. Further, the effect size of the difference in mean gain scores of EG and CG was found to be of medium size (Cohen's  $d = 2.17578$ ).

$$\text{Cohen's } d = (M_2 - M_1) / S_{d_{\text{pooled}}}$$

$$S_{d_{\text{pooled}}} = \sqrt{((SD_1^2 + SD_2^2) / 2)}$$

$$\text{Cohen's } d = (9.768 - 0.946) / 4.054637 = 2.17578$$

Hence the null hypothesis stating "There exists no significant effect of Mindfulness based intervention on Meta-Cognitive Skills of students" stands rejected. Hence, it can be interpreted that the Mindfulness intervention had significant effect on the Meta-Cognitive Skills of the students. In other words, the Meta-Cognitive Skills of students in EG improved significantly after intervention as compared to students in CG. Studies conducted by Flook et al. (2010); Chiesa et al. (2011); Vago and David (2012); Chiesa et al. (2013); and Razza et al. (2013) are supporting the above results.

#### IMPLICATIONS OF THE STUDY:

The present study evaluated the effect of Mindfulness-based Intervention on meta-cognitive skills among students in the age group 10-12 years studying in 6<sup>th</sup> grade. This study has yielded significant results, which can have valuable implications for students in particular and teachers/educators in general.

It is interesting to note that even though there was significant improvement in meta-cognitive skills of students in both the groups, yet the improvement in the EG over CG was exponentially high as the comparison of mean gain scores have shown. These results strengthen the idea to use such interventions/programs in schools.

The finding implies that incorporating such mindfulness programs in schools can enhance meta-cognitive skills (viz. declarative knowledge, conditional knowledge, procedural knowledge, planning, monitoring/self-regulation and evaluation), which in turn can improve their overall learning experience and may result in improved academic performance.

#### CONCLUSION:

In light of the present findings, it can be concluded that mindfulness-based intervention/ practices can boost the meta-cognitive skills of the students. Further, since the mindfulness-based activities are simple and easy to carry out, these can be easily and effectively incorporated in the school curricula.

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